theories, comparing as it does, in particular, the services of mechanical and mathematical theories, is of great interest. The aspect of a theory brought out so strongly by Mendeléeff's words, "By a theory I mean a conclusion drawn from the accumulated facts we now possess which enables us to foresee new facts which we do not yet know," might, perhaps, have been more emphasised.

Of Mill's canons of induction our author disposes in a very workmanlike manner. The chapter on chance and probability seems to us to contain some very sound and valuable remarks on the fundamental assumptions of this difficult study. An example in this chapter has already drawn down the wrath of an eminent mathematician; this example, which deals with the drawing of a given ace from a piquet and a whist pack side by side, at first sight appears to be made the ground of a somewhat perverse comment on ordinary reasoning, since it is admitted that the ordinary estimate of the probability is "right"; but actually it leads up to a point of some importance. The usual assumption is that the choice of either pack in the first instance is equally probable; but this does not follow from first principles unless further conditions as to blindfolding, and so on, are introduced. Actually, the chooser might well be considerably influenced in his choice by the relative size of the packs; and what is really the probability of drawing a given ace is a matter for experiment under conditions rigorously specified. The point brought out, though perhaps not that on which most stress is laid, is that the given conditions are often not stated precisely enough in problems of this nature.

The discussion on probability is continued in the second part, where the subject of errors of measurement is investigated. The criticism here is searching, but is not likely to be accepted in its entirety without debate: the suggestion that the physicist will more frequently find distributions in his notebooks which give a curve like the letter "A" with its top removed than a Gaussian curve will scarcely be accepted. No doubt his arguments will receive more detailed consideration from the experts than is possible here.

The chapter on units and dimensions deserves particular attention. It contains valuable observations on no-dimensional magnitudes and formal constants, as well as some startling suggestions, including what seems to be an implication that the arrangement of the terms in a dimensional equation is of importance.

Dr. Campbell writes with enthusiasm and seeks the combat where it is thickest. The chief fault of his style arises from a desire to deal with every possible comment that might be raised and hence to labour points which are sufficiently obvious. There is a certain lack of co-ordination, which he acknowledges; in fact, one of the things which render it an ungracious task to criticise is that the author is keenly alive to deficiencies in the book, and is always anxious to point them out himself. The work gives the impression of brilliant and informed table-talk on the basis of physics carried on evening after evening, the amount of thought devoted to any particular point depending largely on the mood of the moment. There is little doubt that most readers will find Dr. Campbell provocative in parts, but, whatever else he may provoke, he provokes thought. Finally, it is a great feat to have assembled so much interesting matter, and to have put together a book containing so much fresh thought on a subject of fundamental interest. It is to be hoped that the interest taken in this book will prove amply sufficient to encourage the author to bring out the contemplated remainder of the treatise.

E. N. DA C. ANDRADE.

Mind and Brain.

In Search of the Soul and the Mechanism of Thought, Emotion, and Conduct. By Dr. B. Hollander. Vol. i.: *The History of Philosophy and Science from Ancient Times to the Present Day.* Pp. x+516. Vol. ii.: *The Origin of the Mental Capacities and Dispositions of Man and their Normal, Abnormal, and Supernormal Manifestations.* Pp. vii+361. (London: Kegan Paul, Trench, Trubner, and Co., Ltd.; New York: E. P. Dutton and Co., n.d.) *2l. 2s.* net two vols.

THAT the psychological phenomena loosely grouped together under the term "mind" are in some way correlated with the physiological activities of the brain is a proposition which may be regarded as having been generally accepted for more than a century past; the question, however, as to what is the nature of that correlation still remains unsolved. The fact that this particular question must be allowed to lie in abeyance does not militate against the very legitimate attempt to locate differentiated mental functions in relation to the various structural parts of the brain, and as a matter of course many observers have sought to produce a psycho-physiology of the brain.

The human brain is chiefly remarkable, from the point of view of comparative anatomy, for the extraordinary development of the cerebral hemispheres, which conceal practically all the other portions of the brain. They constitute virtually a great pall consisting of a grey surface or cortex, composed of many layers of innumerable nervecells, and a white medulla or stalk, composed of millions of nerve-fibres which connect the cortical cells with one another, with other structures in the brain, and with the body tissues generally. Conceive this mantle with a surface divided up by a very constant pattern of grooves and elevations the marvellously complex and unique structure of which had just come to light; then, bearing in mind the "faculty" psychology which was generally held a century ago, it is easy to comprehend the high hopes entertained and the attempts that were made to parcel out the faculties on to the surface so naturally prepared. From these attempts to localise the higher mental functions before the nature of cerebral physiology was at all understood arose the cult of phrenology and all the charlatanism to which it gave rise.

To the serious student, phrenology, the lore of telling the character from the prominences of the skull, became quickly discredited because it was obvious that, as the thickness of the skull bones varied irregularly, the external configuration of the skull bore no definite relation to the surface of the brain underneath. This circumstance did not interfere with the followers of the mental localisation theory, but they themselves soon began to experience difficulties of their own. To obtain any agreement on the matter of localisation, it was first of all necessary that each observer should hold precisely the same views as to the division of the mind into faculties, and this essential preliminary gave rise to much difficulty, because very few persons were agreed on the subject. Many schemes were propounded and much argument took place until it was seen that, from the purely psychological point of view, the "faculty" conception of psychology was untenable. From regarding, for instance, the quality of aggressiveness as a separate entity, the opinion was formed that it was a trend of the personality as a whole. Moreover, the independent experiments of the physiologists and the observations of the neurologists began to take definite shape, quite apart from the speculations of the philosophical psychologists.

A great deal of knowledge has now accumulated, and modern opinion, which is supported by the vast amount of detail derived from the many cases of head injury in the war, is very definitely against any possible cortical localisation of separate mental faculties. The modern theory is embraced by the broad statement that the cortex is to be considered as a vast associational mechanism functioning as a whole, the chief purpose of which is one of inhibition of the lower activities of the nervous system; in other words, it is the mechanism whereby a considered intellectual activity is substituted for an emotional reflexive type of reaction to environment. The cortex contains the termini of the various sensory streams of nerve-fibres arising in all parts of the body, and also the origin of the motor nerve-fibres going out to the muscles of the body. Apart from these connections, which have now been mapped with fair accuracy and are termed the sensory and motor areas respectively, there is no question of there being any real mental localisation. If the cortex be injured outside one of these areas, the individual becomes generally irritable or lacks control, and at the same time loses to a certain extent the capacity for intellectual thought.

Dr. Hollander, so one gathers from his book, does not agree with modern opinions. He prefers to stand by the old "faculty" psychology and the corresponding physiological ideas, and he has produced a monumental work in support of his views. In the very interesting first volume of his book he takes the reader right from the beginning of recorded philosophical speculation up to present-day knowledge of the mind and brain, extracts being given from and personal references made to practically every writer on the subjects under discussion. This mass of information, collated with a care that the reader will appreciate, must have involved a tremendous literary research and labour. It is only marred by the fact that the author stresses or belittles the facts to so great an extent in the effort to establish his point. His defence of the physiologist Gall, who was one of the first to take up the matter of cerebral localisation, is masterly; so much so that one sighs that such energy, ingenuity, and thought should have been expended in the resuscitation of a bygone stage of knowledge when there is so much new ground to be explored.

The second volume is disappointing. Here we have Dr. Hollander's views on many things; too many things really to be included within the same cover. A considerable portion of this volume is devoted to the development of his argument on behalf of the cerebral localisation of mental function, and to this end he lays down his psychology, which is of the faculty type and singularly lacking in reference to the most recent developments; *e.g.* there is no mention of such illuminating conceptions as that of the defence mechanisms or of the influence of the sympathetic and endocrine systems upon the mind. His treatment of the question of insanity is in the style of a very commonplace abridged text-book, not at all what one would have expected in a book of this kind; while some of his statements, though they may safely be left to the judgment of the professional reader, require a little criticism for the benefit of the layman in these matters.

Dr. Hollander, like all enthusiasts, is inclined to lay the onus of failure of vision on those who do not agree with him. He disposes of his opponents on the ground that they do not follow out his system; but he must realise that some of the greatest intellects in science have been busy on these problems, and that they cannot all be wrong and only he be right. He must give a little credit to the labours of such men as Sir Frederick Mott, Sir Victor Horsley, and many others one might mention. Again, the difficulty the physicians of our mental hospitals have to face is not the fact that they are not allowed to fulfil their duty—they have every opportunity to do that in the very efficient and well-equipped modern mental hospital—but the attitude of the friends and relatives of the mental patient who, for sentimental reasons, oppose any effort to place the patient under proper care in the early stages of the disorder. As regards the question of treatment, of course everyone is entitled to whatever opinion he chooses, but it may be as well to point out that the consensus of modern opinion is that the day has not yet dawned when mental disorder can be treated by the surgeon. In a few cases of very definite brain injury an operation might be considered, but, even so, it is often found that the patient's last state is no better than the first.

Space does not permit of any detailed criticism of the remaining chapters of the book; it must suffice to say that the author passes on from criminology to thought reading and allied subjects, and ends upon a metaphysical note. The book is well written and well arranged; every credit must be given for the truly immense labour involved in its compilation; but it is to be feared that it is too much out of joint with the times to exercise much effect on the opinion of the day on these matters.

Mineralogy for Students.

(1) *Economic Mineralogy: A Practical Guide to the Study of Useful Minerals.* By T. Crook. Pp. xi+492. (London: Longmans, Green, and Co., 1921.) 25*s.* net.

(2) *Mineralogy: An Introduction to the Study of Minerals and Crystals.* By Prof. E. H. Kraus and Dr. W. F. Hunt. Pp. xiv+561. (New York and London: McGraw-Hill Book Co., Inc., 1920.) 27*s.*

EACH of these books is intended both as a text-book for students and as a work of reference for practical men.

(1) In Mr. Crook's case the reader has the advantage of his life-long employment on the economic investigation of minerals, while his experience as a lecturer enables him to appreciate the difficulties of the beginner. He carefully avoids unnecessary excursions into theoretical considerations, but his explanations, so far as they extend, are exceptionally clear and simple. He gives considerable attention to the optical examination of crystals, on account of its value in recognising minerals; and there is a helpful chapter on the use of the blowpipe and chemical methods generally. Another chapter is concerned with the physical analysis of crushed rocks and loose detrital sediments, a subject that the author has made peculiarly his own; and the short account of the geology of mineral deposits should be of use to the prospector.

The greater portion of the book is, however, devoted to a detailed description of the minerals of practical importance. The arrangement and treatment are frankly based on economic considerations, which should be a recommendation to all who are engaged in the commercial development of mineral resources. Moreover, Mr. Crook does not confine his attention to minerals in the strictly scientific meaning of the word, but includes all that is covered by the legal and technical definition of the term—everything which is mined for its economic value—so that coal, asphalt, and petroleum find their place in his survey. He also deals briefly with building materials and road metal. The volume concludes with some useful determinative tables, which are set out in such a manner that it is possible to glance rapidly through them in search of the information required. The text is illustrated by clear diagrams, and by excellent photographs of minerals taken by the author himself.

(2) Prof. Kraus and Dr. Hunt present us with a treatise of a somewhat more elaborate character, largely compiled from previous publications of one or both of the authors. Considerable attention is devoted to crystallography, and there are detailed tables for determining minerals. In the general description of the commoner minerals they are arranged according to the usual chemical classification, but there is a separate chapter on gem-stones, and another in which the minerals are classified according to the elements to which they owe their economic value. Monazite, however, appears in this section under cerium, which, although present in considerable amount, is of little commercial importance, instead of under thorium, for which it is almost exclusively worked. The use of tetra- (instead of tetarto-) in referring to a quarter-pyramid in the triclinic